REMARKS

In response to the examiner's suggestion that the claims are too broad, the claims have been substantially amended, both to simplify the language used in the claims and to amplify the description of the invention. For example, claim 1 recites "performing a pattern based search." A person of ordinary skill in the art would understand such a search to be a search that uses move sets (patterns) to explore the search space. For example, moving two steps in the x-direction and one step in the y-direction is a possible pattern in 2D component layout. The magnitude of the steps is controlled by the step size control parameter. See Second Declaration of Dr. Aladahalli, paragraph 5.

In the initial stages of the search, the step sizes are large so that the algorithm can reach any point in the search space. As the algorithm proceeds, the step size is decreased until a threshold step size is reached after which the algorithm terminates. At a given step size, a trial move is attempted along a pattern direction. Any step that leads to a better state (as measured, for example, by a decrease in an objective function) is accepted and a trial move is attempted again and so on. Only when all attempts to make a successful move at a step size have failed, is the step size reduced. See Declaration of Dr. Aladahalli, paragraph 6.

Claims 1 and 23 now incorporate this meaning of pattern based search in the claim by reciting "successively generating a plurality of new component configurations by applying a plurality of moves and evaluating an objective function at each of said plurality of new configurations until a final configuration is selected and output." It is respectfully submitted that those of ordinary skill in the art understand the meaning of the phrase "pattern based search," but to eliminate even the possibility of an ambiguity, the definition has now been added to claim 1.

Claims 1 and 23 have been further amended to describe how the presently claimed invention differs from the usual pattern based search. Specifically, claims 1 and 23 recite "wherein a criterion other than the size of the move is used to determine the order in which the moves are applied."

"Step size" is a phrase well understood in the art as discussed on paragraph [0023] from the published application.

> From an arbitrary initial state of the components, translation moves are first applied. Components are randomly selected and are translated, thus generating a new state. A new state is accepted if it

results in an improvement in the objective function, else the
original state is retained. This process is repeated for all
components. If there is no improvement for any of the translations
attempted, the step size for translations is scaled down by a factor
less than, but close to 1. Next the rotation moves are applied. A
component is picked at random and rotated. The same rules (as for
the translation moves) for new state acceptance and step size
updating apply here. If none of the translations and rotations
results in an improved objective function, swap moves are applied.
A swap move swaps the positions of two randomly picked
components.

Even though "step size" is well understood in the art, that phrase has been replaced with
the "plain English" phrase the "size of the move." Additionally, the phrase "driving the search"
and the term "metric" no longer appear in claims 1 and 23. In view of the changes to claims 1
and 23, it is respectfully submitted that claims 1 and 23 clearly recite the type of search to which
those claims apply - a search which successively generates a plurality of new component
configurations by applying a plurality of moves and evaluating an objective function at each of
the plurality of new configurations until a final configuration is selected and output. Claims 1
and 23 clearly recite how the subject matter that is being claimed differs from the prior art
pattern based search - wherein a criterion other than the size of the move is used to determine the
order in which the moves are applied. It is respectfully submitted that the Lundah reference does
not render obvious amended claims 1 and 23.

Lundahl is directed to a method and system for the dynamic analysis of data represented
in distinct matrices. If two data matrices X and Y are present in which corresponding rows of X
and Y each refer to the same underlying object, a relationship can be developed between the X
and Y data matrices, which allows for a prediction of responses in Y on the basis of inputted X-
data. If a third data matrix Z is present in which corresponding columns of Y and rows of Z each
refer to the same underlying object, a relationship can be developed between the X, Y, and Z
data matrices. [Lundahl, Abstract] Lundahl has nothing to do with pattern based searching, as
that phrase is used in the present application. See Second Declaration of Dr. Aladahalli,
paragraphs 8 and 9.

Lundahl, at column 38, lines 19-54 and column 42, lines 20-32 does not disclose or
suggest using any criterion for determining the order in which moves are applied, and certainly

does not disclose or suggest a criterion other than the normally accepted "move size" to determine the order in which the moves are applied. Because the cited portions of Lundahl are silent on how the order of application of the moves is determined, claims 1 and 23 are believed to be patentable over the Lundahl reference.

Claims 2 and 24 have been amended to recite that the "amount of change" in value of the objective function is the criterion of interest. The move that is expected to cause the greatest amount of change in value in the objective function is the move that is selected next. Support for that language can be found, for example, in the Abstract of the published application which provides in part:

> Preprocessing algorithms are disclosed which quantify the effect each move has on the objective function. Those moves having a greater effect on the objective function are applied before moves having a lesser effect.

The cited portion of Lundahl does not disclose or suggest determining which moves have the greatest effect on the objective function and applying those moves before applying moves having a lesser effect on the objective function. Claims 2 and 24 are believed to be in condition for allowance.

Claims 3 and 25 have been cancelled. Sensitivity is the term the inventors have used to characterize the effect a move has on the objective function. See, for example, the Abstract of the published application which provides in part:

> We call this effect on the object function the sensitivity of the object function to a particular move and present several methods to quantify it.

Thus, claims 3 and 25 were believed to be substantially duplicative of amended claims 2 and 24, respectively.

Claims 4 and 26 have been substantially amended. The limitations of "performing a pattern based search" and "outputting a component layout" have been replaced with the steps needed to perform the search. Furthermore, unlike claims 1 and 23, which recite that a criterion other than step size is used to determine the order in which the moves are applied, claims 4 and 26 recite what that criterion is – sensitivity, i.e., the effect the moves have on a set of components determines the order in which the moves are applied. Those moves which cause a greater effect

are applied first, regardless of the size of the those moves. Unlike a traditional pattern based search in which the moves are applied according to size, with the largest moves applied first, and then gradually smaller and smaller moves, the claimed method applies those moves having the greatest effect first, followed by moves that have a progressively smaller effect. The methods recited in claims 4 and 26 represent a completely different methodology for performing pattern based searches and proceed contrary to the art. The cited portions of Lundahl are silent with respect to using the effect that moves have on an objective function to determine the order in which moves should be applied.

With respect to claims 5-10 and 27-32, those claims have been amended to make it clear that moves are ordered according to the effect that the moves are expected to have on the objective function. Support for this amendment can be found in paragraph [0050], among others, which provides:

> We emphasize here that the above definition is not unique, but it serves the purpose of measuring how much a move might affect the objective function. Sensitivity could be derived analytically, probabilistically or heuristically. In a preferred embodiment, sensitivity would be computed in a statistical sense, i.e., conduct a large number of experiments with random placement of the components, apply the move whose sensitivity we are interested in computing and take an average of the change in the objective. (emphasis added)

Lundahl does not recognize using an expected change in objective function to determine the order in which moves are applied, so it follows that Lundahl does not disclose the details of these dependent claims regarding the specifics of how to order or rank the moves.

In the final Office action, the examiner states on page 7, with reference to independent claims 11, 16, 33, and 38, that:

> Lundahl anticipates ranking each of a plurality of moves on a set of components based on the effect each move has on an objective function; and ordering the moves from those moves having the highest ranking to those moves having the lowest ranking (**Lundahl**, c 32:5-22). (emphasis in original)

The cited portion of Lundahl provides as follows:

> Finally, as indicated by OUTPUT 2040 of FIG. 10, various outputs are achieved. First, the calibration process outputs a vector,

x_pred$_{rank}$, that is used for ranking the X-prediction <u>variables in importance</u> from the Y=[G X]$_{PLS}$ model. If B is the coefficient matrix for the latter model, then B(i,:) is the row of B corresponding to the ith X variable used in the modeling. The "score" given to this variable is the sum of the absolute value of the elements of B(i,:). Secondly, the calibration process outputs another vector, x_descrim$_{rank}$, <u>that is used for ranking the X-classification variables for their so-called discriminatory power from the alternate discriminatory power method.</u> Third and finally, the calibration process outputs the estimated condition number of the variance-covariance type matrix, X$_{OLS}$ ' X$_{OLS}$, for the Y=[G X]$_{OLS}$ model, along with an associated indicator, no$_{OLS}$. If no$_{OLS}$ =1, the estimated condition number is greater than five hundred; otherwise, no$_{OLS}$ =0. (emphases added)

There is nothing in the cited portion of Lundahl that discloses "a set of components" or "ranking each of the plurality of moves on a set of components based on the effect each move is expected to have on an objective function." Furthermore, Lundahl does not disclose "storing the ranking for use in ordering the moves from those moves having the highest ranking to those moves having the lowest ranking."

One aspect of the method recited in these claims is that it is necessary, not to maximize or minimize an objective function as suggested by the examiner, but to order the moves from those moves that are expected to have the largest effect on the objective function to those moves that are expected to have the least effect on the objective function. That ordering is saved and used during the performance of a pattern based search to control the order in which the moves are applied, i.e., applying the moves in order from those moves that have the most effect to those moves that have the least effect. See paragraph [0088] of the published application which provides:

> The present disclosure introduces a new algorithm, Sensitivity-based Pattern Search (SPS) for 3D layout. This algorithm, though based on the Generalized Pattern Search algorithm accounts for the fact that different moves affect the objective function by different amounts and therefore classifies the moves in decreasing order of their effect on the objective function and applies them in that order. This effect is called the sensitivity.

The methods recited in claims 11 and 16 and apparatus of claims 33 and 38 are directed to the process of determining which moves are expected to have the greatest effect (positive or

negative) on the objective function. That information is used to guide the order in which the moves are applied during a pattern based search. It is during the search that the objective function is evaluated to see if the move represents an improvement. This "preprocessing" concept, i.e., determining which moves are expected to have the greatest effect on the objective function, is not disclosed or suggested in Lundahl. Claims 11, 16, 33, and 38 are believed to be patentable over Lundahl.

Dependent claims 12-15, 17-20, 34-37, and 39-42 recite details of how the ranking or groupings may be performed. Because Lundahl does not recognize the preprocessing concept recited in the base claims, Lundahl does not disclose or render obvious the details of how the preprocessing concept may be implemented as set forth in the dependent claims. It is believed that dependent claims 12-15, 17-20, 34-37, and 39-42 are patentable over Lundahl.

Independent claims 21 and 43 are also directed to this preprocessing method of determining which moves are expected to have the greatest effect (positive or negative) on the objective function. That information is used to guide the order in which the moves are applied during a pattern based search. It is during the search that the objective function is evaluated to see if the move represents an improvement. Lundahl, as previously stated, does not recognize this preprocessing method. Claims 21, 22, 43, and 44 are believed to be patentable over Lundahl.

This space left blank

Request for Interview

The applicants have made a diligent effort to place the instant application in condition for allowance. If the examiner is of the opinion that the instant application is in condition for disposition with respect to the art currently of record other than through allowance, the examiner is respectfully requested to contact applicants' attorney at the telephone number listed below **so that an interview may be scheduled before the issuance a final Office action rejecting the claims**.

Respectfully submitted,

Edward L. Pencoske
Registration. No. 29,688
Jones Day
One Mellon Center
500 Grant Street, Suite 3100
Pittsburgh, PA, USA, 15219
Direct Dial: (412) 394-9531
Facsimile: (412) 394-7959
Attorneys for Applicants